

Name Key + 66

Date _____

AP: CHAPTER 2 CHEMICAL CONTEXT OF LIFE

- +2 1. What is meant by the term *trace element*? Give some examples of trace elements.

Trace elements are required by an organism in only minute quantities. Ex - Fe, I

- +2 2. What are the most common elements in the human?

C, O, H, N \rightarrow 96%

P, S, Ca, K \rightarrow 4%

- +1 3. Helium has an atomic number of 2 and atomic mass of 4. Explain?

The atomic # indicates just the number of protons

The atomic mass indicates the total mass of an atom

(Protons + neutrons + electrons)

- +2 4. Define isotope and give some examples.

Isotopes are different forms of the same element in which the # of protons remains the same but the # of neutrons changes. Examples ^{12}C , ^{13}C , ^{14}C

- +2 5. How are isotopes used in biology?

Radioactive isotopes can be used to date fossils & as medical tracers

- +1 6. What happens when electrons change energy levels?

They absorb or lose energy

+1 7. What is the significance of valence numbers?

Valence numbers give an idea of the reactivity of the element depending on the capacity of the valence shell

* This number tells you the # of electrons that are capable of reacting

+1 8. Why do atoms form covalent vs. ionic bonds?

Covalent Bonds will form when the electronegativity of an atom is not strong enough to take an electron from another resulting in the electron being shared. If the electronegativity is strong enough an ionic bond is formed

+1 9. How do non-polar covalent bonds differ from polar covalent bonds?

A non-polar covalent bond shares electrons equally between atoms while a polar covalent bond does not share electrons equally resulting in an unequal distribution of charge

+3 10. What is a hydrogen bond? How does it form and how is it different from a covalent bond?

A Hydrogen bond is a bond that forms between 2 molecules as a result of the positive Hydrogen covalent being attracted to the negative of another covalent bond. This differs from a covalent bond in a covalent bond is btwn. 2 atoms while a hydrogen is between 2 molecules

+8 11. Place the appropriate letter next to each statement.

C—covalent bonding I—ionic bonding H—hydrogen bonding

a. I Electrons transfer between atoms.

b. C Atoms share electrons.

c. I This bond is present in sodium chloride.

d. C This bond is present in the oxygen molecule.

e. C A triple bond of this type is present in nitrogen gas.

f. H This bond forms between water molecules.

g. H The hydrogen atom in one molecule is attracted to the oxygen atom of another molecule.

h. C This bond forms within a water molecule.

12. At least two forms of the oxygen atom exist in the environment: $^{16}_8\text{O}$ and $^{18}_8\text{O}$.

- +1/2 a. Each atom has eight electrons. $^{16}_8\text{O}$ and $^{18}_8\text{O}$ represents isotopes of the element oxygen.
- +1/2 b. The numbers 16 and 18 represent the Atomic Mass.
- +1/2 c. The atomic number of $^{16}_8\text{O}$ is 8.
- +1/2 d. The atomic number of $^{18}_8\text{O}$ is 8.
- +1/2 e. the number of protons in the atom of $^{16}_8\text{O}$ is 8.
- +1/2 f. The number of protons in the atom of $^{18}_8\text{O}$ is 8.
- +1 g. How do $^{16}_8\text{O}$ and $^{18}_8\text{O}$ differ in number of subatomic particles? $^{16}_8\text{O}$ has eight neutrons and $^{18}_8\text{O}$ has 10 neutrons

+8 13. Complete the following table with the correct numbers:

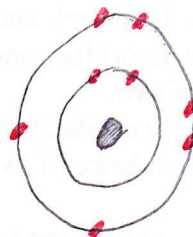
Isotope	Protons	Neutrons	Atomic Number	Atomic Mass
$^{12}_6\text{C}$	6	6	6	12
$^{14}_6\text{C}$	6	8	6	14
$^{31}_{15}\text{P}$	15	16	15	31
$^{33}_{15}\text{P}$	15	18	15	33

14. Draw the electron shell diagram for these atoms

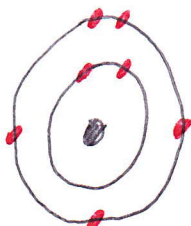
- +1 a. ^6_6C 1/2 structure
1/2 paired correctly



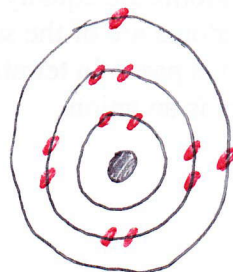
- +1 c. ^8_8O



- +1 b. ^7_7N



- +1 d. $^{12}_{12}\text{Mg}$



- +1 15. Look again at the electron shell diagram you drew for carbon (a) in question 12. Did you show the outer electrons unpaired? Why?

Yes, each orbital can hold a pair of electrons, however, each electron fills a separate orbital until no empty orbitals remain.

Select the best answer.

- +1 B 16. Each element has its own characteristic atom in which

- a. the atomic mass is constant.
- b. the atomic number is constant.
- c. the mass number is constant.
- d. two of the above are correct.
- e. all of the above are correct.

- +1 D/F 17. Radioactive isotopes can be used in studies of metabolic pathways because

- a. their half-life allows a researcher to time an experiment.
- b. they are more reactive.
- c. the cell does not recognize the extra protons in the nucleus, so isotopes are readily used in metabolism.
- d. their location or quantity can be experimentally determined because of their radioactivity.
- e. their extra neutrons produce different colors that can be traced through the body.

- +1 A 18. In a reaction in chemical equilibrium,

- a. The forward and reverse reactions are occurring at the same rate
- b. the reactants and products are in equal concentration.
- c. the forward reaction has gone further than the reverse reaction.
- d. there are equal numbers of atoms on both sides of the equation.
- e. a, b, and d are correct.

- +1 E 19. Oxygen has eight electrons. You would expect the arrangement of these electrons to be

- a. eight in the second electron shell, creating an inert element.
- b. two in the first electron shell and six in the second, creating a valence of six.
- c. two in the 1s orbital, and two each in the three 2p orbitals, creating a valence of two.
- d. two in the 1s orbital, one each in the 2s and three 2p orbitals, and two in the 3s orbital, creating a valence of two.
- e. two in the 1s orbital, two in both the 2s and 2p orbitals, and one each in the 2py and 2pz orbitals, creating a valence of two.

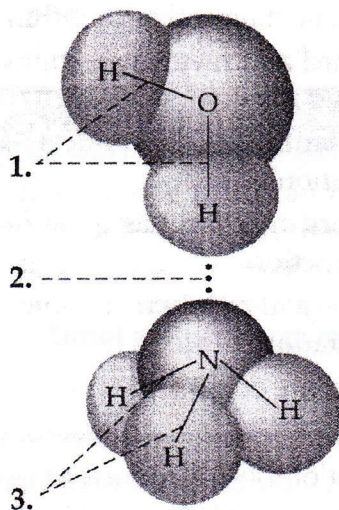
- +1 A 20. A covalent bond between two atoms is likely to be polar if

- a. one of the atoms is much more electronegative than the other.
- b. the two atoms are equally electronegative.
- c. the two atoms are of the same element.
- d. the bond is part of a tetrahedrally shaped molecule.
- e. one atom is an anion.

- +1 E 21. A triple covalent bond would
- be very polar.
 - involve the bonding of three atoms.
 - involve the bonding of six atoms.
 - produce a triangularly shaped molecule.
 - involve the sharing of six electrons.

- +1 D 22. A cation
- has gained an electron.
 - can easily form hydrogen bonds.
 - is more likely to form in an atom with seven electrons in its valence shell.
 - has a positive charge.
 - Both c and d are correct.

- +1 B 23. What types of bonds are identified in the following illustration of a water molecule interacting with an ammonia molecule?



- Bonds 1 are polar covalent bonds, bond 2 is an ionic bond and bonds 3 are nonpolar covalent bond.
- Bonds 1 and 3 are polar covalent bonds, and bond 2 is a hydrogen bond.
- Bonds 1 and 3 are polar covalent bonds, and bond 2 is an ionic bond.
- Bonds 1 and 3 are nonpolar covalent bonds, and bond 2 is a hydrogen bond.
- Bonds 1 and 3 are polar covalent bonds, and bond 2 is a nonpolar covalent bond.

- +1 E 24. Which of the following weak bonds may form between any closely aligned molecules?
- nonpolar covalent
 - polar covalent
 - ionic
 - hydrogen
 - van der Waals interactions

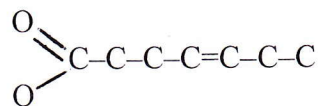
- +1 C 25. The ability of morphine to mimic the effects of the body's endorphins is due to
- a chemical equilibrium developing between morphine and endorphins.
 - the one-way conversion of morphine into endorphin.
 - molecular shape similarities that allow morphine to bind to endorphin receptors.
 - the similarities between morphine and heroin.
 - hydrogen bonding and other weak bonds forming between morphine and endorphins.

Use this information to answer questions 26 through 31.

The six elements most common in living organisms are:



- +1 B 26. How many electrons does phosphorus have in its valence shell?
- 3
 - 5
 - 7
 - 15
 - 16
- +1 C 27. What is the atomic mass of phosphorus?
- 15
 - 16
 - 31
 - 46
 - 62
- +1 C 28. A radioactive isotope of carbon has the mass number 14. How many neutrons does this isotope have?
- 2
 - 6
 - 8
 - 12
 - 14
- +1 B 29. How many covalent bonds is a sulfur atom most likely to form?
- 1
 - 2
 - 3
 - 4
 - 5
- +1 E 30. Based on electron configuration, which of these elements would have chemical behavior most like that of oxygen?
- C
 - H
 - N
 - P
 - S
- +1 C 31. How many of these elements are found next to each other (side by side) on the periodic table?
- one group of two
 - two groups of two
 - one group of two and one group of three
 - one group of three
 - all of them
- +1 D 32. Taking into account the bonding capacities or valences of carbon (C) and oxygen (O), how many hydrogen (H) must be added to complete the structural diagram of this molecule?



- 9
- 10
- 11
- 12
- 13

+1 B 33. A sodium ion (Na^+) contains 10 electrons, 11 protons, and 12 neutrons. What is the atomic number of sodium?
a. 10 c. 12 e. 33
b. 11 d. 23

+1 A 34. What type of bond would you expect potassium ($^{39}_{19}\text{K}$) to form?
a. ionic; it would donate one electron and carry a positive charge
b. ionic; it would donate one electron and carry a negative charge
c. covalent; it would share one electron and make one covalent bond
d. covalent; it would share two electrons and form two bonds
e. none; potassium is an inert element

+1 C 35. What is the molecular shape of methane (CH_4)?
a. planar or flat, with the H arranged around the C
b. pentagonal, or a flat five-sided arrangement
c. tetrahedral, due to the hybridization of the *s* and three *p* orbits of the C
d. circular, with the four H attached in a ring around the C
e. linear, since all the bonds are nonpolar covalent

+1 B 36. Which of the following is a molecule capable of forming hydrogen bonds?
a. CH_4
b. H_2O
c. NaCl
d. H_2
e. a, b, and d can form hydrogen bonds

+1 C 37. Chlorine has an atomic number of 17 and a mass number of 35. How many electrons would a chloride ion have?
a. 16 c. 18 e. 34
b. 17 d. 33

+1 D 38. What is the difference between a molecule and a compound?
a. There is no difference; the terms are interchangeable.
b. Molecules contain atoms of a single element, whereas compounds contain two or more elements.
c. A molecule consists of two or more covalently bonded atoms; a compound contains two or more atoms held by ionic bonds.
d. A compound consists of two or more elements in a fixed ratio; a molecule has two or more covalently bonded atoms of the same or different elements.
e. Compounds always consist of molecules, but molecules are not always compounds.

+1 E 39. Which of the following atomic numbers would describe the element that is least reactive?
a. 1 c. 12 e. 18
b. 8 d. 16

+1 E 40. What coefficients must be placed in the blanks to balance this chemical reaction?



- a. 5; 5; 5 c. 6; 6; 6 e. 8; 5; 6
b. 6; 5; 6 d. 8; 4; 6